MULTI-ENTRANCES SECURITY DOOR SYSTEM

YASOTHA A/P PADMANATHAN

This thesis is submitted as partial fulfillment of the requirements for the award of the Bachelor of Electrical Engineering (Hons.) (Electronics)

Faculty of Electrical & Electronics Engineering
Universiti Malaysia Pahang

JUNE, 2012

ABSTRACT

Over the years, several security measures have been employed to combat the menace of insecurity of lives and property. This is done by preventing unauthorised entrance into buildings through entrance doors using conventional and electronic locks or discrete access code. Thus, the main idea in this project is to design a database security system that allows only authorised user to enter the premises. There are two entry point with each using different technologies; RFID & keypad. Once the user's identification is verified, the door is unlocked by using EDL (electronic door lock) and all the information such as user ID, date and time are stored in central office. The communication between the entrance points with central office by means of Zigbee wireless technology.

ABSTRAK

Sejak beberapa tahun kebelakangan ini, beberapa langkah-langkah keselamatan yang telah digunakan untuk memerangi ancaman yang mengancam keselamatan nyawa dan harta benda. Ini dilakukan dengan menghalang kemasukan ke dalam bangunan dengan menggunakan kunci konvensional dan elektronik atau kod akses diskret. Oleh itu, idea utama dalam projek ini adalah untuk merekabentuk satu sistem pangkalan data keselamatan yang membolehkan hanya pengguna yang sah sahaja boleh memasuki premis. Terdapat dua pintu masuk dengan setiap pintu menggunakan teknologi yang berbeza; RFID & pad kekunci. Selepas pengenalpastian pengguna disahkan, pintu dibuka dengan menggunakan EDL (kunci pintu elektronik) dan semua maklumat seperti ID pengguna, tarikh dan masa yang disimpan di pejabat pusat. Komunikasi antara pintu masuk dengan pejabat pusat adalah dengan menggunakan teknologi “wireless” ZigBee.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

RFID	-	Radio Frequency Identification
LCD	-	Liquid Crystal Display
MHz	-	Megahertz
GHz	-	Gigahertz
RF	-	Radio frequency
UART	-	Universal Asynchronous Receive Transmit
PIC	-	Programmable Intelligent Computer
V	-	Volts

LIST OF APPENDIXES

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Security and safety have always been of prime concern to every individual or an organization. Safety is the guarantee for the most essential existent of human beings. A security system is necessary for a building or an area to guarantee the safety of the residents and property. The security system has gone through single-route monitor system, control loop monitor system, and processor plus multimedia monitor system eras in the past twenty years. The digital monitor system which used abroad today is the fourth era production of the security system.

It's very annoying that all of the security systems show many shortcomings such as the signals transmitted through cable network, wiring network is a severe time-consuming and high-load work, and it always blocks the progress of the engineering, the information can be watched only in monitoring chamber. It's very difficult to extend system, because the wire connection is fixed, high energy-consuming system and the after-effect is very serious if the cable be cut.

No matter if the building is a corporate setup, home, a public place or a factory, it has become imperative to secure it against potential dangers such as theft, crime, and fire etc. An intelligent system is therefore required which should not only detect but also pre-empt such hazards. Today it has to be updated with the rapidly changing technology to ensure vast coverage, remote control, reliability, and real

time operation. Deploying wireless technologies for security and control in security systems offers attractive benefits along with user friendly interface. The advancements in security and information technologies have led to availability of many off the shelf products. Unfortunately the conventional solutions such as CCTV security solutions, IP network video solutions and fire alarm systems are too costly in terms of deployment and power efficiency; they are application specific, making them void to provide all in one.

For this reason, the Multi-Entrances Security Door System project is proposed. This project uses technology such as Radio Frequency Identification and Zigbee to provide further security system that can be implemented in offices and home premises.

1.2 WIRELESS TECHNOLOGIES

Radio Frequency Identification (RFID) and Zigbee are two wireless technologies that have each developed hosts of applications independent of each other. Each has benefits, with ZigBee supporting advanced sensor networks and RFID suitable for low-power wireless tracking of people and objects.

1.2.1 Radio Frequency Identification (RFID)

Radio Frequency Identification (RFID) is a new technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum to uniquely identify an object, animal, or person. There is a wide research and development in this area trying to take maximum advantage of this technology, and in coming years many new applications and research areas will continue to appear. This massive growth in RFID also brings about some concerns, mainly the security and privacy of those who work with or use tags in their everyday life. RFID technology is much more secure compared to other networks.

RFID technology consist of RFID reader and RFID tags. RFID tags are also called RFID transponders and they are divided into passive and active RFID tags. In this project passive tags are being used. This technology allows the system nodes or tags to exchange data via radio frequency signal communication. After receiving a radio signal, the tags process this information in order to answer back the basic data required for identifying the tag uniquely. This data is processed in the reader side with the help of software tools such as an auxiliary database or some other communication system. Some of the most popular applications of the RFID technology include, object and good authentication, access control for vehicles and humans, race timing, animal identification, product tracking and inventory systems, etc.

1.2.2 Zigbee

ZigBee is one of the typical short-range wireless communication technologies, which has been widely used in a certain application areas including the family network, control network, mobile phones and other mobile terminals in foreign countries. ZigBee is a software standard that sits on top of the IEEE802.15.4 low data rate wireless standard. The ZigBee (IEEE 802.15.4) is a new technology that permits the implementation of Wireless Personal Area Networks (WPAN). It is very suitable for wireless sensor networks due to the very low power consumption. The selection of the Radio Frequency (RF) communication modules used for the wireless transmission part in this project is based on several criteria. They are range of communication, power consumption, ease of integration and the cost. So, for this project the XBee PRO wireless modules is chosen which conform to the IEEE 802.15.4 standard.

This system uses ZigBee to build transmission network, which is used for the transmission of sensor data, and uses customized wireless transmission protocol, which is designed based on simplicity and reliability. In the protocol, considering simplifying microcontroller functions of RFID & ZigBee node and reducing system cost, the wireless transmission protocol mainly achieves the capabilities of error checking, data framing, conflict mechanisms such as retransmission, etc.

1.3 PROBLEM STATEMENT

The existing security systems show many shortcomings such as difficult to extend and severe time-consuming because it is based on wiring network technology. For a wired network, certain levels of security are maintained since access to the physical medium is restricted to the devices physically connected to the network. It is very difficult to extend the system, because the wire connection is fixed. In additon, there are also insecurity in system identification due to the information can be watched only in monitoring chamber. Failure of keeping or tracking the database leads to increasing theft or insecurity to the lives and properties.

1.4 OBJECTIVES

To develop and design a secure door security system using various form of technology such as Radio frequency Identification (RFID) with a secure and effective Zigbee wireless transmission of data.

1.5 SCOPE OF PROJECT

The scope of this project is:

- Develop at least 2 different type of user identification such as using Radio Frequency Identification (RFID) & keypad.
- Use wireless transmission technology such as RF & Zigbee for nodes communication.
- Develop a database at master node for analysis.

1.6 THESIS OUTLINE

Multi-entrances Security Door System project's final thesis is a combination of 6 chapters that contains and elaborates specific topics such as the Introduction, Literature Review, Hardware Implementation, Software implementation, Result and discussion and Conclusion.

Chapter 1 is the Introduction of the project. The explanation for the project will be given in a general term. The objectives of the project will be elaborated. It is followed by the explanation in the scope of project and also the problem statements.

Chapter 2 is the Literature review for the development of multi-entrances door security system. This chapter describes the literature review of the project elaborately. Explanation will be focused on security system related researched and based on theory and conceptual ideas. Some literature reviews of current existing projects based on security system are also be discussed.

Chapter 3 is the Hardware design.. The explanation gives according to the function in the board. Flow of the project and how it is executed is explained in detail. This section gives explanation more towards on technical part of it.

Chapter 4 is the Software implementation part. Software development of the project is discussed here. Software used and how it is executed will be discussed here.

Chapter 5 discussed about results of testing conducted for the project. All the testing results are shown here with appropriate explanation.

Chapter 6 discusses the conclusion and further development of the project. This chapter also discussed about the total costing involved and potential of this project for commercialization.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Security is the condition of being protected against danger, loss, and criminals. In the general sense, security is a concept similar to safety. The slight difference between the two is an added importance on being protected outside threats or dangers. Individuals or actions that go or act against the general rules of protection are responsible for the breach of security.

Security has to be compared and contrasted with other related concepts: Safety, continuity, reliability. The key difference between security and reliability is that security must take into account the actions of people attempting to cause destruction. There is an immense literature on the analysis and categorization of security.

In this chapter, the review of literature is explained briefly with the guidance of the existing projects conducted by researchers for the development of the project, multi-entrances security door system. In literature review, the technologies such as Radio Frequency Identification (RFID) and Xbee Pro wireless technology that is used in this multi-entrances security door system is further discussed.

2.2 SYSTEM APPLICATIONS CONDUCTED BY RESEARCHERS

Over the years, security system is implemented in various places. A security measure plays an important role in daily life. Some of the researchers have conducted and successfully developed various types of security systems using different technologies.

2.2.1 The Design and Implementation of Intelligent Campus Security Tracking System Based on RFID and ZigBee

The project [1] is designed by Xiaokang Li and Li Gao and it is based on RFID and ZigBee wireless technology. The intelligent campus security tracking system uses physical methods and electronic technology, automatically detects theft in monitoring areas, generates alarm signals, and tracks targets through the detection point of RFID.

Figure 2.1 shows the flow of the operating system for the project. RFID & ZigBee nodes sense the RFID (master / slave) labels and it then send information in the labels to the ZigBee network real time, which is then transferred to the PC nodes. PC checks the label information in the database, when master label and slave label match or only master label appears; the system recognizes it as legal input. But when only slave label appears or master label and slave label don't match, the system recognize it as illegal input, then step to is proceeded. Position changes of RFID (slave) the tags are recorded, slave tags are tracked, and warning are shown at PC nodes. Then the database is keep tracked, looking for the owner of items and confirming information is sent to the owner through the system. When the owner logins WEB to search for items, he can see the real-time location of his valuables according to the hints. After confirmation, the valuables will be stopped at the entrance guard. As for false information, the owner can cancel this warning.

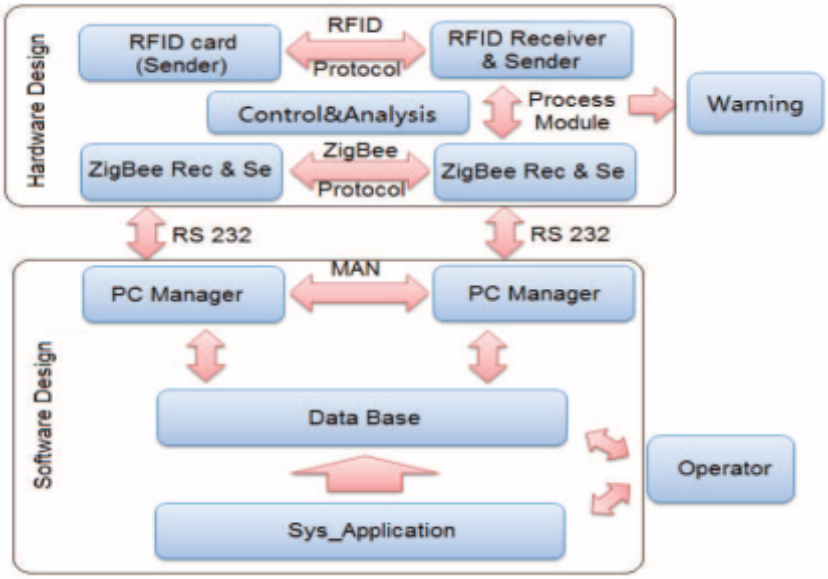

Figure 2.1: System architecture designed by Xiaokang Li and Li Gao

2.2.2 Scalable ZigBee-Based Smart Authentication and Access Control System Design Using XMOS Programmable Chips.

Wael Hosny Fouad Aly, Haytham Aboulabbas M., Moustafa H. Aly, Hossam Eldin Moustafa, have presented their paper on Scalable Zigbee based smart authentication and access control [2]. In their research paper, they have discussed an efficient, inexpensive, scalable, and ZigBee-based smart authentication and access control system that consists of a central node and remote nodes. The central node holds a database of authorized users and it is mesh-networked to a set of remote nodes which are spread throughout the premises of an enterprise. The goal of the system is to provide an online electronic access control system that will automate entry to the premises of an enterprise according to pre-assigned user credibility. The system consists of a central node and distributed remote nodes. Remote nodes are installed at the main entrance gates of the enterprise as well as at the office doors within the premises and wherever user tracking is required to be maintained by the system. Once a user carrying the RFID tag is in the vicinity of the reader that reside in the remote node at the main entrance gate, the tag will be detected and its ID number is read by the RFID reader module and is then transferred over the IEEE 802.15.4 wireless link to the central node to verify whether access is granted to enter or not. Upon proper authentication by the central node, the programmable chip that resides in the corresponding remote node will trigger an electric door strike that will allow the user to open the main entrance gate. Figure 2.2 shows the overall system model that has been proposed.

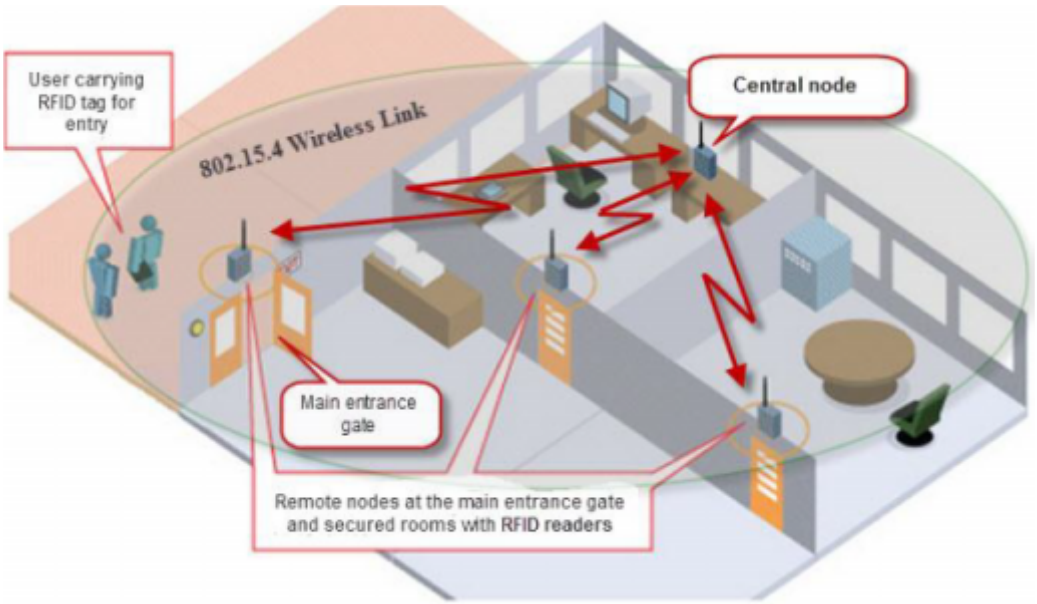

Figure 2.2: Model system proposed by Wael Hosny Fouad Aly, Haytham Aboulabbas M., Moustafa H. Aly, Hossam Eldin Moustafa

2.2.3 Wireless Networked Security System Based on ZigBee Technology.

In [3], present a wireless networked security system based on ZigBee technology. The system adopts hybrid topology structure based on cluster, which consists of many micro-sensor nodes, network coordinator nodes, network gateway (router), communication network and monitor centre (computer). For short distance transmission, the micro-sensor nodes collect data from the monitoring surroundings and transmit to the gateway using ZigBee communication. For long distance transmission, from the gateway to the monitor centre, system uses TCP/IP protocol. The gateway in this system is the protocol conversion used to transform a data package in ZigBee protocol to TCP/IP protocol before transmitting.

2.2.4 Building a Smart University using RFID Technology

In this paper [4], the researchers contemplate present the use of RFID technology in building a smart university. Prototype is developed considering major use cases involved in a smart university. The system covers maintaining attendance record, switching control of electrical items and security locks of rooms. Results show that consumption of energy and object tracking time is decreased while security of rooms and credibility of attendance record are increased. ZigBee is selected for this research due to its low cost, long communication range and low power consumption.

System is working as follows: First Reader detects RFID card and forward that ID to microcontroller. Microcontroller authenticates the ID and generates a specific number (3 byte code) against that ID. This specific number is then forwarded to the ZigBee transceiver via serial link from where it is broadcasted to receiving nodes. One of the receiving nodes is the database server where attendance record is managed. At the same time control circuit node receives the broadcast and automates the office equipments based on that specific profile. The profiles can be modified from the server as they are stored in NVRAM. Figure 2.3 shows the block diagram of the system.

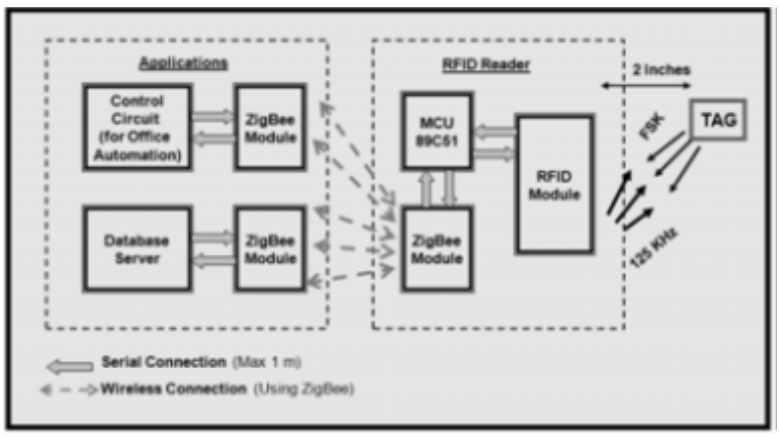

Figure 2.3: Block diagram of the system

2.2.5 Implementation of ZigBee-GSM based Home Security Monitoring and Remote Control system.

Arbab Waheed Ahmad, Naeem Jan, Saeed Iqbal, Chankil Lee [5], discusses on implementation of a novel security and control system for home automation. The proposed system consists of a control console interfaced with different sensors using ZigBee. Suspected activities are conveyed to remote user through SMS (Short Message Service) or Call using GSM (Global System for Mobile communication) technology. Upon reply, the remote user can control his premises again through GSM-ZigBee combination. In addition, traditional burglar alarm enhances security in case of no acknowledgment from remote user. This system offers a low cost, low power consumption and user friendly way of a reliable portable monitoring and control of the secured environment. Using the concept of serial communication and mobile phone AT-commands (Attention TelephonelTerminal commands), the software is programmed using C-Ianguage. The design has been implemented in the hardware using ZigBee EM357 module, Atmega128 MCU (microcontroller unit) and Sony Ericsson T290i mobile phone set. Figure 2.4 shows the block diagram and circuit connection of the system.

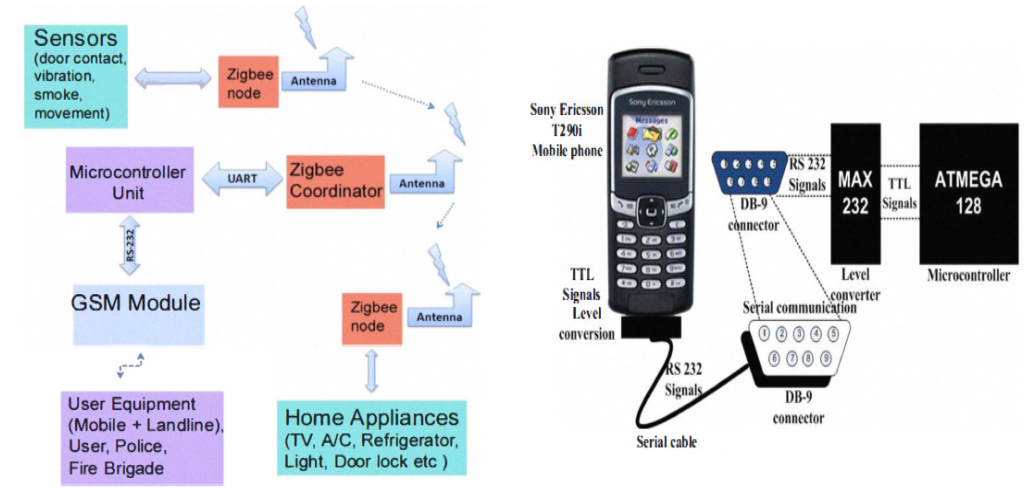

Figure 2.4: block diagram and circuit connection of the system.